

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is as follows:

1 A method of an improved delivery system for gases generated via the sublimation of
2 solid material precursors comprising:

3 introducing a solid precursor into a liquid bubbler apparatus;

4 adding a liquid ^{into} to said solid precursor-containing bubbler apparatus, said liquid chosen to
5 have a vapor pressure which is negligible compared with said vapor pressure of said solid
6 precursor under the operating conditions extant in said bubbler; said liquid also being chosen
7 such that said solid precursor is sufficiently insoluble in said liquid such that recrystallization
8 of material of said solid precursor is unobservable during the normal operating time required
9 to deplete the precursor material in said bubbler and necessitate its refilling;

10 attaching said bubbler containing said solid precursor and said liquid to a reactor apparatus
11 containing a substrate to which the precursor is to be applied; said bubbler containing a
12 mixture of vapors comprising carrier gas and solid precursor; said carrier gas being either
13 inert or reactive;

14 flowing said carrier gas through said bubbler to sweep said mixture of vapors into said
15 reactor to coat said substrate.

1 ✓ 2. The method defined in claim 1 wherein the vapor pressure of said liquid is less than
2 10^{-8} Torr at room temperature.

1 ✓ 3. The method defined in claim 1 wherein said solid precursor is any material having a
2 solubility in said liquid of less than 1000 ppm.

1 ✓ 4. The method defined in claim 3 wherein said solid precursor is any material having a
2 solubility of less than 100 ppm.

✓ 5. The method defined in claim 3 wherein said liquid is a silicone oil oligomer.

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6. The method defined in claim 3 wherein said solid precursor material is selected from the group consisting of molybdenum, niobium, tantalum and tungsten.

✓ 7. The method defined in claim 6 wherein said solid precursor material is tungsten.

1 ✓ 8. The method defined in claim 6 wherein said solid precursor material is tungsten
2 hexacarbonyl.

1 ✓ 9. The method defined in claim 6 wherein wherein said substrate comprises silicon,
2 silicon dioxide or silicon nitride.

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10. The method defined in claim 1 wherein said solid precursor material is selected from the group consisting of molybdenum, niobium, tantalum and tungsten.

11. The method defined in claim 1 wherein: said solid precursor is selected from the group consisting of molybdenum, niobium, tantalum and tungsten;

said liquid added to said solid precursor-containing bubbler apparatus has a vapor pressure less than 10^{-8} Torr at room temperature;

said solid precursor has a solubility in said liquid of less than 1000 ppm;

said substrate to which said precursor is to be applied is selected from the group consisting of silicon, silicon dioxide or silicon nitride; said carrier gas being either a noble gas or ammonia.

12. The method defined in claim 11 wherein said solid precursor is tungsten, said liquid is a silicone oil oligomer and said carrier gas is argon.

✓ 13. The method defined in claim 12 wherein said carrier gas is ammonia.

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